What is claimed is:

1. An RF module comprising:

a first waveguide for propagating electromagnetic waves in a TEM mode; and

a second waveguide connected to the first waveguide, for propagating electromagnetic waves in another mode different from the TEM mode,

wherein the second waveguide has a region surrounded by at least two ground electrodes facing each other and conductors for bringing at least two ground electrodes into conduction, electromagnetic waves propagate in the region,

the first waveguide extends in a direction orthogonal to a stacking direction of the ground electrodes, an end of the first waveguide is directly or indirectly connected so as to be conductive to one of the ground electrodes of the second waveguide from the direction orthogonal to the stacking direction, and

magnetic fields of the first and second waveguides are coupled in an E plane of the second waveguide so that the direction of the magnetic field of electromagnetic waves propagated in the first waveguide and that of the magnetic field of electromagnetic waves propagated in the second waveguide match with each other.

2. An RF module according to claim 1, wherein the second waveguide is to propagate electromagnetic waves in a TE mode.

3. An RF module according to claim 1, wherein the first waveguide is positioned between the ground electrodes facing each other in the second waveguide, and

an end of the first waveguide is conductively connected to one of the ground electrodes facing each other.

4. An RF module according to claim 1, wherein the first waveguide has a line pattern made of a conductor formed on a dielectric substrate.

5. An RF module according to claim 4, wherein a plurality of penetrating conductors penetrating the dielectric substrate are provided around the line pattern and

the interval in the width direction of the penetrating conductors is equal to or less than a cut-off frequency of the electromagnetic waves propagating through the first waveguide.

6. An RF module according to claim 5, wherein coupling between the first and second waveguides is adjusted by adjusting the interval of the penetrating conductors.

7. An RF module according to claim 1, wherein a penetrating conductor for coupling adjustment is provided in a coupling portion between the first and second waveguides.

8. An RF module according to claim 3, wherein a window is provided in at least one of a ground electrode side to which the first waveguide is conductively connected and the side opposite to the ground electrode side in the coupling portion of the first waveguide.

9. An RF module according to claim 1, wherein the second waveguide has a stacking structure in which three or more ground electrodes are stacked and has a plurality of propagation regions for propagating electromagnetic waves in the stacking direction, and

an end of the first waveguide is conductively connected to the ground electrode between neighboring propagation regions in the second waveguide.

10. An RF module according to claim 9, wherein an end of the first waveguide is conductively connected to a ground electrode between neighboring propagation regions in the second waveguide so that electromagnetic waves propagated through the first waveguide are branched and propagated into the plurality of propagation regions in the second waveguide.

11. An RF module according to claim 1, wherein the first waveguide is a strip line, a microstrip line, or a coplanar line.

12. An RF module according to claim 1, wherein the second waveguide is to propagate electromagnetic waves in a multiple mode.

13. A mode converting structure for converting a mode between different waveguides of: a first waveguide for propagating electromagnetic waves in a TEM mode, and a second waveguide connected to the first waveguide, for propagating electromagnetic waves in another mode different from the TEM mode,

wherein the second waveguide has a region surrounded by at least two ground electrodes facing each other and conductors for bringing at least two ground electrodes into conduction, electromagnetic waves propagate in the region,

the first waveguide extends in a direction orthogonal to a stacking direction of the ground electrodes, an end of the first waveguide is directly or indirectly conductively connected to one of the ground electrodes of the second waveguide from the direction orthogonal to the stacking direction, and

magnetic fields of the first and second waveguides are coupled in an E plane of the second waveguide so that the direction of the magnetic field of electromagnetic waves propagated through the first waveguide and that of the magnetic field of electromagnetic waves propagated through the second waveguide match with each other.

14. A method for converting a mode in a structure comprising: a first

waveguide for propagating electromagnetic waves in a TEM mode; and a second waveguide connected to the first waveguide, for propagating electromagnetic waves in another mode different from the TEM mode, the second waveguide having a region surrounded by at least two ground electrodes facing each other and conductors for bringing at least two ground electrodes into conduction, and electromagnetic waves propagating in the region,

wherein the first waveguide extends in a direction orthogonal to a stacking direction of the ground electrodes, an end of the first waveguide is directly or indirectly connected conductively to one of the ground electrodes of the second waveguide from the direction orthogonal to the stacking direction side, and

magnetic fields of the first and second waveguides are coupled in an E plane of the second waveguide so that the direction of the magnetic field of electromagnetic waves propagated through the first waveguide and that of the magnetic field of electromagnetic waves propagated through the second waveguide match with each other.